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Automated Helmet Detection System

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Abstract

Last few years Sensor Networks become active research area due to its wide range of application. In this paper, we investigate the use of a Wireless Sensor Network for Automated Helmet Detection. In India, more than 37 million people are using two wheelers. Since usage is high, the accident percentage of two wheelers are also high compared to four wheelers. Two wheelers have a high rate of fatal accidents than four wheelers. The impacts of these accidents are more dangerous when the driver involves in a high speed accident without wearing helmet. It is highly dangerous and can be fatal. So wearing a helmet can reduce this number of accidents and may save the life. Automated Helmet Detection System(AHDS) is a proposal aims for reduction of the possibility of fatal accidents of two wheelers. The system has the ability to detect whether the driver of the two wheeler is wearing a helmet. The system will prevent the start of the two-wheeler if it detects that the driver is not wearing any helmet.

Keywords: Sensor Network, Helmet Detection, Datta Collection.

Introduction

Sensor network comprises of small sensor nodes integrating environmental data collection, data computations and data communication functionalities. Once the sytem is deployed the sensor nodes can communicate with each other in order to collect and transmit data to the local monitoring system [1,2]. We obserb applications of Wireless Sensor network in various fields like: environmental monitoring, indoor climate control, surveillance, structural monitoring, medical diagnostics, disaster management, emergency response, ambient air monitoring, and gathering sensing information in health care organosation.
[3, 4, 5, 6]. Sensor nodes have limitations in energy consumption and computations due to their low cost and hardware precincts. Researchers are now a day's focus to overcome these limitations through more energy efficient routing, localized high level of computations to reduces delay due to high traffic in a network, improve channel capacity and modern system design.

State Of The Art Of Helmet Detection System

In [8], the authors have described a method that focus on the making of a smart helmet by providing the means and apparatus for detecting and reporting accidents by using wireless setup.

The authors focused on detection of a motorcyclist without helmet by using the circular Hough transform and the Histogram of Oriented Gradients descriptor to extract the image attributes [9]. In automatic helmet detection system, the system detects the motorcyclist without helmet through CO2 Sensor as well as infrared temperature the authors have proposed a model that force, sensing resistor and a BLDC fan that are used to detect the riders head and detection of motorcycle speed respectively. When the rider buckled the helmet then only the two wheeler starts.

The authors suggested an idea using equipment which consists of microcontroller along with IR and PIR sensors for helmet authentication followed by alcohol detection with the help of MQ3 sensor. As soon as the two wheeler rider trsensor.

In [10] the authors conceived a methodology that design a module which can identify moving two-wheelers and verify whether the rider is wearing a helmet or not. If not, it will extract the license plate and locate the contact information the vehicle owner and issue an automatic ticket.

The authors have proposed a portable, low cost, laser detection system which generates an alarm signal that can be used to produce visual and/or audible warnings indicating the range, location and type laser energy detected[11].

In [12]ies to start the two wheeler it shall authenticate if the person is wearing the helmet through IR and PIR sensors. Secondly, MQ3 sensor detects the presence of alcohol, if detected the two wheeler won't start [13].

Phase Design Of Proposed Model

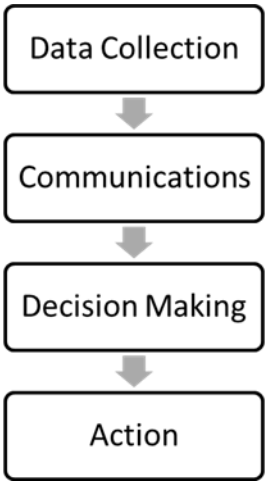


Fig 1: Phase Diagram

The proposed model of Automated Helmet Detection Syatem (AHDS) has four phases. In figure 1 the. phases are given according to their functionalities.

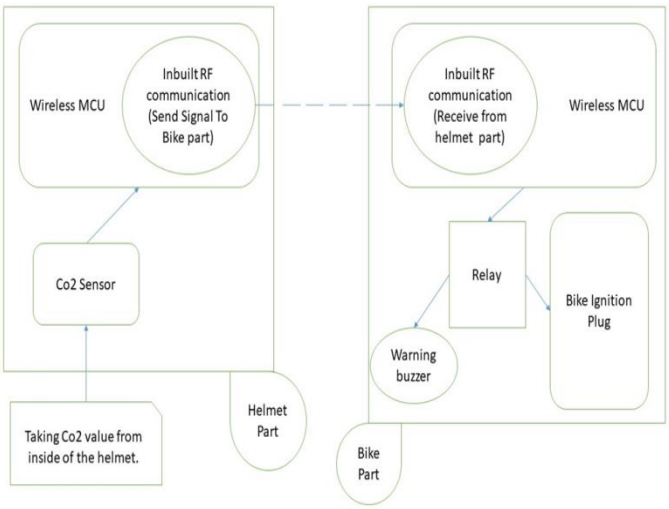
a. Phase1: This phase is termed as Data Collection phase where the sensors gather environmental data.
b. Phase 2: In phase 2 communications are done between helmet part and the bike part. In this phase the microcontroller send the collected data (from phase1) to the bike part through RF signal
c. Phase 3: This is the decision making phase. In this phase decision is taken by calibrating the received data with the threshold value.
d. Phase 4: This is the action phase. It is the phase where action is to be taken according to the decision. If the collected value is more than threshold then the bike will start.Abbreviations and Acronyms

Challenges Of Proposed System

1.The aim of this model is to develop a computational methodology to detect motorcyclists with/without helmets. The main contribution of this work is related to a general solution to decrease frequent road accidents and reduce the rate of deaths caused due to head injuries of motorcyclists. But, some challenges are there, that may affect the performance of the proposed models.
2.There can be a problem of system process failure (although after intimating the rider through buzzer alert) if the rider opens the helmet in the middle of the journey while riding the bike. The engine will be switched off after giving alert to the user and it will not start until the rider re-wears the helmet.
3. helmet will be uniquely programmed with a particular bike system. So the rider cannot use any other helmet (may be of same type) in any circumstances.
4.The system is calibrated with certain values of carbon dioxide which is taken from the sensor embedded in the helmet. So if any regular source of carbon dioxide is found from any object other than human exhalation, and the values are matched with the calibrated values of the system then there is a chance of the system getting activated in an unauthorized manner. Though it has been tested multiple times taking different types of CO2 concentrations, so chances of this kind of failure is comparatively very less.

Proposed Model

The motivation of the proposed work is to improve surveillance regarding motorcyclists wearing full and proper helmet specifically in the locations where the use of helmets is mandatory. Here the functionality of the proposed AHDS is given in terms of block diagram and algorithm.
Block Diagram: The block diagram, shown in figure 2, of our system is divided into two parts i.e. helmet part and the bike part.



Helmet part:
In the helmet part there is a CO2 sensor which measures the amount of CO2 inside the helmet. It generally used solid electrolyte cell Principle. The amount of CO2 the bike rider exhale it takes that much of density. After collecting the co2 value it sends the value to the micro controller unit for further checking, at the MCU it takes the value and send the value to the bike part through radio frequency.
Bike part:
In the part there are a wireless microcontroller unit and a relay. Here the microcontroller unit receives the data from the helmet through the radio frequency channel. After that the data will checked with the threshold value. If the value satisfies the threshold value then the relay will switched to the ignition plug of the bike. And hence the bike will start .

Algorithm:

The functionality of helmet and bike are described in the following algorithms:

Algotithm Helmet:
Collect CO2 sensor value for n times
SensorValue:= CO2 sensor value
Sum:= Sum+ SensorValue
Avg: =Sum/n
Send Avg to Receiver

In this algorithm the sensor present at helmet collect CO2 density value from environment and store in SensorValue. The data is collected for n times, where n is any natural number. After collecting the sensor values, those values are summed and then average is calculated using normal average calculation process. Then this average is send to the Receiver at the Bike.

Performance Analysis

This section describes the performance analysis of the proposed system. The performance is measured with the help of some hardware components and software tools.

Hardware Specification:

- CC1310 LAUNCHPAD: Figure 3 shows the diagram of CC1310 which is a microcontroller that consists of Wi-Fi , Bluetooth low energy, Sub-1 GHz, Ethernet, ZigbFig 3: CC1310 Micro Controller
- MG811 C02 SENSOR: Figure 4 demonstrates sensor module MG-811 which has gas sensor on-board and circuitry to enable to work out of box. This MG811 sensor module is a little bit special because it require 6VDC to function properly. There is an on-board signal conditioning circuit for amplifying output signal and an on-board heating circuit for heating the sensor.

Fig 4:MG811 CO2 Sensor

- BRUSHLESS MOTOR: A brushless DC electric motor (BLDC motor or BL motor), also known.

Fig 5: Brushless Motor

as electronically commutated motor (ECM or ECmotor).and synchronous DC motors. are synchronous motors powered by direct current (DC) electricity via an inverter or switching power supply which produces electricity in the form of alternating current (AC) to drive each phase of the motor via a closed loop controller. The controller provides pulses of current to the motor windings that control the speed and torque of the motor.

Software Specifications:

Energia: The Energia IDE is cross platform and supported on Mac OS, Windows, and Linux. Energia uses the mspgcc compiler by Peter Bigot and is based on the Wiring and Arduino framework.

Fig 6: Energia IDE

Result Analysis:

The following plots will show the changes in carbon di oxide density when the helmet is putting on or putting down. In the figure 7 , it is shown that when the biker is putting on the helmet the density of carbon di oxide is increased and reaches threshold so the Bike will get start.

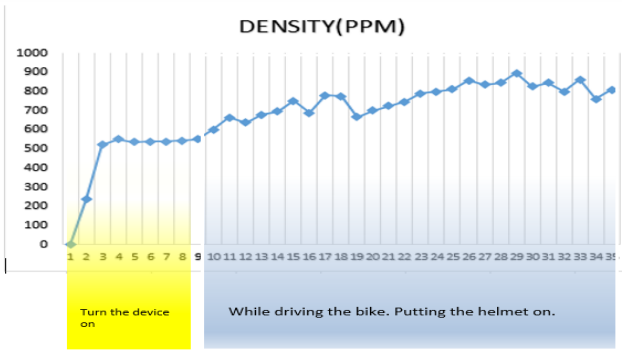


Fig 7: Helmet in putting on by Biker

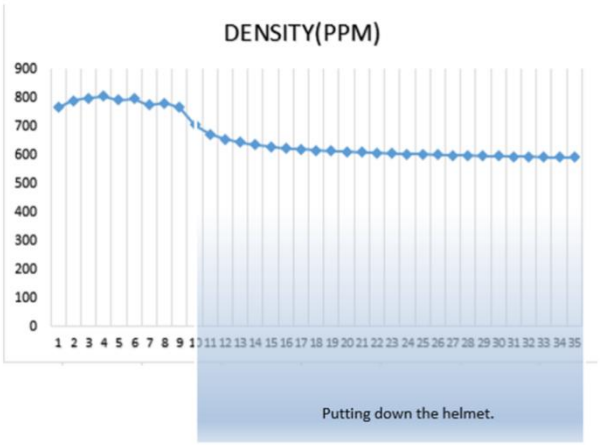


Fig 8: Helmet in putting down

Conclusion

In this paper, automatic helmet detection system working principle is described where the system can identify whether the biker uses helmet or not using carbon di oxide density. Only one parameter is used in this system. Threshold value selection is important to ger perfect result and improves system efficiency. In future, the system will be incorporated with some other sensors, so more parameters can be taken care and system performance can be enhanced.

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